

In Situ Aerobic Cometabolic Bioremediation

A Collaborative Effort between the US EPA Western Region Hazardous Substance Research Center, AFRL/MLQE, and AFIT/ENV

THE APPROACH

Groundwater contamination by chlorinated compounds such as trichloroethylene (TCE) is a serious national problem. In situ aerobic cometabolism relies upon the ability of native bacteria to completely degrade these contaminants when the bacteria are supplied with a source of food (*i.e.*, a primary substrate) and oxygen. The fact that the technology is applied in situ means that the contaminants are destroyed without having to remove them from the ground.

This technology uses an innovative system of in situ mixing wells to supply oxygen and the primary substrate to the native bacteria, without having to bring contaminated groundwater to the surface.

FIELD DEMONSTRATION

In situ aerobic cometabolic bioremediation was demonstrated on a site at Edwards AFB, CA, with TCE-contaminated groundwater. Two treatment wells were installed, as shown in the Figure 1. Each well had two screens. One well operated in an upflow mode, the other in a downflow mode. The treatment wells were used to mix the contaminated groundwater with toluene (the primary substrate) and oxygen. The mixture was then injected into "bioactive" zones in the aquifer, which contained bacteria capable of consuming the toluene. While oxidizing the toluene, the bacteria produced an enzyme that destroyed the TCE.

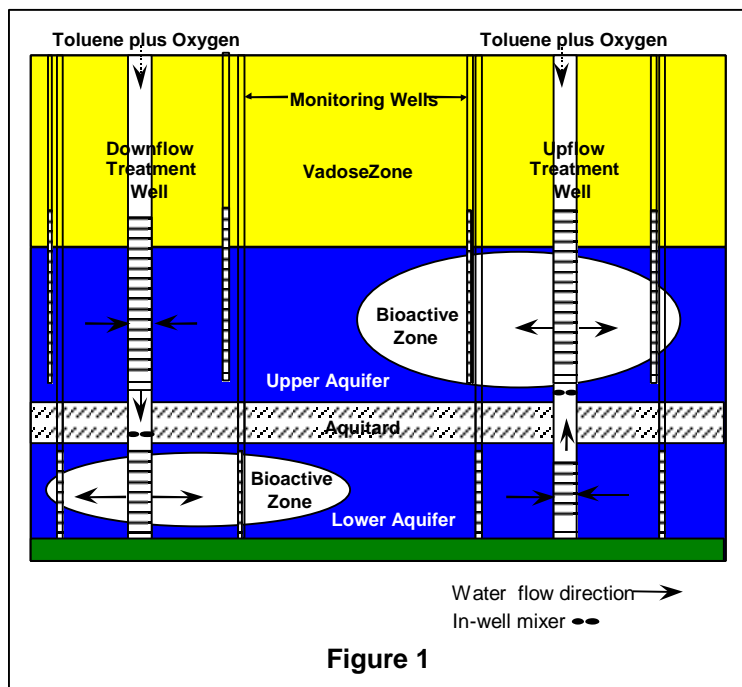


Figure 1

As depicted in Figure 1, the aquitard at the Edwards AFB site separates the upper and lower screens of the two treatment wells. Model analyses have shown that under typical geological conditions, a similarly configured treatment system will be effective in achieving mixing at other types of sites. As shown

in Figure 2, the treatment system at Edwards AFB successfully reduced TCE concentrations (above 1,000 $\mu\text{g/L}$) upgradient to less than 30 $\mu\text{g/L}$ downgradient of the system. This is an overall removal of greater than 97%. Details of the Edwards AFB demonstration, including results and modeling analyses, may be found in McCarty *et al.* 1998. (*Environmental Science and Technology*, 32(1):88-100).

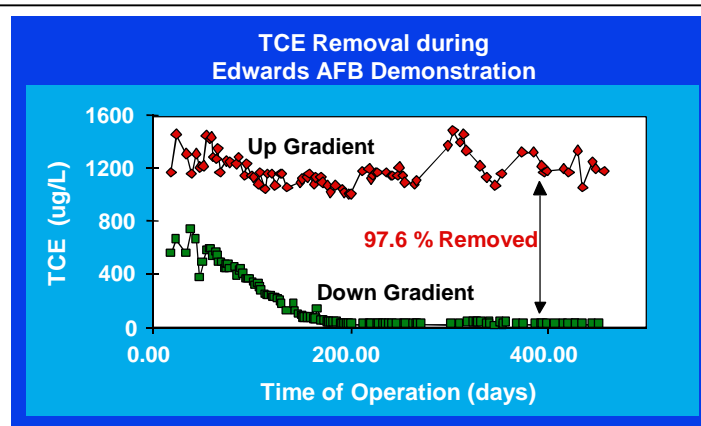


Figure 2

PRODUCTS OF RESEARCH

To facilitate use of this technology to address groundwater contamination problems of the Nation and the DoD, interactive screening software, a technology guidance manual, and a software user's guide were created. The software and the guide are designed to provide site owners, consultants, and regulators who are attempting to remediate a contaminated site with information to help them decide if this technology is applicable for their particular problem.

If the technology turns out to be appropriate, the software and guide provide important information and reference material that can be used to design the remediation system. Both the software and the user's guide can be downloaded from the Internet: <http://en.afit.af.mil/env/insitubio.htm>.

POINTS OF CONTACT:

Erica Becvar

Air Force Research Laboratory
Airbase and Environ Technology Div
AFRL/MLQE (ARA, Inc.)
139 Barnes Drive, Suite 2
Tyndall AFB FL 32403-5323
erica.becvar@mlq.af.mil

Ph: 850-283-6225
Fax: 850-283-6064
DSN 523-6225

Mark Goltz

Air Force Institute of Technology
Dept of Engrg & Environ Mgt
2950 P Street, Bldg. 640
Wright-Patterson AFB OH 45433-7765
[m Holtz@afit.af.mil](mailto:mholtz@afit.af.mil)

Ph: 937-255-6565
x4314
Fax: 937-656-4699